NON-PUBLIC?: N
ACCESSION #: 8805030238
LICENSEE EVENT REPORT (LER)

FACILITY NAME: Surry Power Station, Unit 2 PAGE: 1 of 4

DOCKET NUMBER: 05000281

TITLE: Manual Reactor Trip Due To Loss Of Vital Bus Caused By Failed Inverter
EVENT DATE: 03/27/88 LER #: 88-004-00 REPORT DATE: 04/26/88

OPERATING MODE: N POWER LEVEL: 100

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR SECTION
50.73(a)(2)(iv)

LICENSEE CONTACT FOR THIS LER:
NAME: D. L. Benson, Station Manager TELEPHONE #: 804-357-3184

COMPONENT FAILURE DESCRIPTION:
CAUSE: X SYSTEM: ED COMPONENT: INVT MANUFACTURER: G185
REPORTABLE TO NPRDS: Y
CAUSE: X SYSTEM: BQ COMPONENT: ISV MANUFACTURER: A391
REPORTABLE TO NPRDS: Y

SUPPLEMENTAL REPORT EXPECTED: No

ABSTRACT: On March 27, 1988 at 1621 hours, with Unit 2 at 100% reactor power, Vital Bus (VB) (EIIS-ED) 2-III was de-energized due to the loss of 2-III inverter (EIIS-INVT). A turbine runback was automatically initiated due to the loss of power to the Power Range Nuclear Instrument NI-43 (EIIS-IG) which is powered from VB 2-III. Abnormal Procedure AP-10.2, "Loss of Vital Bus 1-III or 2-III", was entered and as required by the procedure, the reactor (EIIS-RCT) and 'A' Reactor Coolant Pump (RCP) (EIIS-P), were manually tripped at 1622 hours. Approximately 30 seconds later, a High Steam Flow/Low Reactor Coolant System (RCS) (EIIS-AB) Tavg Safety Injection (SI) (EIIS-BQ) occurred. Operators followed appropriate plant procedures and quickly stabilized the unit following the reactor trip/safety injection. An engineering evaluation of the inverter determined that an internal inductor failed due to age, thus causing a current surge which blew the fuse and tripped the AC output breaker. One of two of the station vital bus inverters per unit have been replaced with an uninterruptible power supply. The remaining two vital bus inverters (2-III and 1-III) will be replaced with uninterruptible power supplies during the upcoming refueling outages.

(End of Abstract)

1.0 Description of the Event

On March 27, 1988 at 1621 hours, with Unit 2 at 100% reactor power, Vital Bus (VB) (EIIS-ED) 2-III was de-energized due to the loss of 2-III inverter (EIIS-INVT). A turbine runback was automatically initiated due to the loss of power to the Power Range Nuclear Instrument NI-43 (EIIS-IG) which is powered from VB 2-III. Abnormal Procedure AP-10.2, "Loss of Vital Bus 1-III or 2-III", was entered and as required by the procedure, the reactor (EIIS-RCT) and 'A' Reactor Coolant Pump (RCP) (EIIS-P), were manually tripped at 1622 hours. Approximately 30 seconds later, a High Steam Flow/Low Reactor Coolant System (RCS) (EIIS-AB) Tavg Safety Injection (SI) (EIIS-BQ) occurred. Following the reactor trip and SI, all control and protection systems functioned as expected with the exception of the following:

1) Auxiliary Feedwater (AFW) (EIIS-BA) flow to 'A' Steam Generator was low.

2) 'B' Main Steam Trip Valve (EIIS-ISV) 2-MS-TV-201B, indicated intermediate position.

3) SI High Head pump discharge valve, 2-SI-MOV-2867D, did not indicate fully closed when isolated after SI termination.

Operators followed appropriate plant procedures and quickly stabilized the unit following the reactor trip/safety injection. Also, the Shift Technical Advisor performed the critical safety function status tree review to ensure specific plant parameters were noted and that those parameters remained within safe bounds.

2.0 Safety Consequences and Implications

The Vital Bus System provides power for critical

instrumentation and reactor protection circuits. It also supplies electrical power to the solenoid for 'A' RCP component cooling water return trip valve, 2-CC-TV-105A. Due to the loss of power to the solenoid, 2-CC-TV-105A closed and isolated cooling flow from the pump. Therefore, in accordance with AP-10.2,

the reactor coolant pump was tripped following the manual reactor trip. The loss of coolant flow to one loop from 100% (2441 MWe) with three loops operating is an analyzed event in which DNB does not occur.

During this event, all channel III components (powered from VB 2-III) failed to their safe position. The other channels remained operable.

In addition, all other safety related systems remained operable during the event and plant parameters remained within the bounds of the accident analysis. Therefore, the health and safety of the public were not affected.

3.0 Cause

The loss of VB 2-III was caused by the sudden loss of 2-III inverter. An engineering evaluation determined that an internal inductor failed due to age, thus causing a current surge which blew the fuse and tripped the AC output breaker.

The logic matrix requirements for the High Steam Flow/Low Tavg Safety Injection is high steam flow in any 2 of 3 steam lines (1 out of 2 channels per line) in coincidence with 2 of 3 low Tavg signals. Since VB 2-III provides power to 1 of 2 steam flow channels on each of 3 steam lines, the High Steam Flow portion of the coincidence was satisfied when VB 2-III was de-energized. VB 2-III also supplies power to 1 of 3 Tavg signals. The second low Tavg signal was generated as a result of the 'A' RCS loop cooldown that occurred when the 'A' RCP was tripped. That completed the 2 of 3 Low Tavg portion of the coincidence and resulted in the SI initiation.

4.0 Immediate Corrective Action(s)

At 1643 hours, VB 2-III was cross-tied to VB 2-I in accordance with MOP 26.15, "Removal of Vital Bus Inverter 2-III".

5.0 Additional Corrective Action(s)

The unit was placed in cold shutdown in order to open the AFW system for inspection. All six motor operated valves were disassembled and inspected and MOVATS testing was performed on the valve operators. The 'A' Steam Generator piping from the AFW discharge header to the Main Feedwater header was examined using fiber optics. The piping was cut in order to remove and inspect the cavitating venturi and the check valve was disassembled and inspected. The three AFW pumps were tested and flowed to each of the three Steam Generators. Discharge pressures, flow rates and Steam Generator levels were compared. During these inspections, no flow obstructions were detected, and testing verified full operability of the system.

Valve indicating lights were adjusted for 'B' Main Steam Trip Valve, 2-MS-TV-201B. No failure to the valve was involved.

It was determined during MOVATS testing of 2-SI-MOV-2867D following the event that the limit switch settings were not reproducible. The limit switch problem was attributed to an oversized gasket between the hand wheel housing and the gear case. The gasket was replaced with one of the appropriate thickness and the valve and valve limit switches operated properly. Maintenance procedures will be enhanced to ensure that appropriately sized gaskets will be used.

6.0 Action(s) Taken to Prevent Recurrence

One of two of the station vital bus inverters per unit have been replaced with an uninterruptible power supply. The remaining two vital bus inverters (2-III and 1-III) will be replaced with uninterruptible

power supplies during the upcoming refueling outages.

7.0 Similar Events

None

8.0 Manufacturer/Model Number

Inverter Gould/120G10000FE
2-SI-MOV-2867D Anchor Darling/3 inch-S350W-DD

ATTACHMENT # 1 TO ANO # 8805030238 PAGE: 1 of 1

VIRGINIA ELECTRIC AND POWER COMPANY
Surry Power Station
P. O. Box 315
Surry, Virginia 23883

April 26, 1988

U.S. Nuclear Regulatory Commission Serial No.: 88-015
Document Control Desk Docket No.: 50-281
016 Phillips Building Licensee No.: DPR-37
Washington, D.C. 20555

Gentlemen:

Pursuant to Surry Power Station Technical Specifications, Virginia Electric and Power Company hereby submits the following Licensee Event Report for Surry Unit 2.

REPORT NUMBER

88-004-00

This report has been reviewed by the Station Nuclear Safety and Operating Committee and will be reviewed by Safety Evaluation and Control.

Very truly yours,

/s/ David L Benson
David L. Benson
Station Manager

Enclosure

cc: Dr. J. Nelson Grace
Regional Administrator
Suite 2900
101 Marietta Street, NW
Atlanta, Georgia 30323

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